NIGHT LIGHTS

...lighting the way

Answering Your Questions About Traffic Sign Retroreflectivity

What is retroreflectivity?

Retroreflectivity is the scientific term that describes the ability of an object to redirect light back to its source. This is very different from the more common *diffuse reflection*, in which light shining on an object is reflected in all directions. When the reflected light from objects reaches our eyes, it makes the objects visible to us. *Retroreflectivity* redirects a majority of the light shining on an object back toward the light's source, making the object appear brighter.

Motorists realize the importance of retroreflectivity whenever light from their headlights shines on traffic signs. Signs made with retroreflective sheeting materials appear to glow in the dark, making them easier to see. These retroreflective **NIGHT LIGHTS** provide important information to motorists as they navigate the nation's highways, streets, and roads at night.

What makes the traffic signs shine at night?

Traffic signs are covered with retroreflective sheeting materials. These materials may be made with tiny glass beads embedded in plastic or a very small, complex pattern of cube corners that work like prisms. Both of these retroreflective materials redirect light back towards its source, but the performance of the materials varies. Photographs of the various sheeting patterns are shown on the Retroreflective Sheeting Identification Guide produced by the Federal Highway Administration (FHWA), and available at http://safety.fhwa.dot.gov/programs/retroref.htm.

Why is the FHWA concerned about the night visibility of traffic signs?

One of the FHWA's primary missions is to improve safety on the nation's roadways. Approximately 42,000 men, women and children have been killed on American roads each year during the past 8 years. While approximately one quarter of all travel occurs at night, about half of traffic fatalities occur during nighttime hours.

While factors like intoxication and fatigue contribute to the disparity between day and night crash rates, it is well known that darkness reduces the visual cues available to the driver and that traffic control devices are harder to see at night. During daylight hours, drivers have a number of visual cues, such as shoulders, pavement markings, roadside vegetation, guardrails, fences, and buildings to make navigation easier. At night many of these cues cannot be seen, unless they are illuminated or retroreflective. Adequately maintained retroreflective signs can improve their nighttime visibility. These **NIGHT LIGHTS** heighten motorists' understanding of the roadway, enhance traffic flow, and have the potential to improve highway safety.

Nighttime visibility of traffic control devices is becoming increasingly important as our population ages. Studies show that starting at age 20, the amount of light needed to see doubles every 13 years. By 2020, about one-fifth of the U.S. population will be 65 years of age or older. In general, older individuals have declining vision and slower reaction times. Signs that are easier to see and read can help older drivers retain their freedom of mobility, remain independent, and reduce their likelihood of being involved in traffic crashes.

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What are the current regulations?

The Manual on Uniform Traffic Control Devices (MUTCD) states, "Regulatory, warning, and guide signs shall be retroreflective or illuminated to show the same shape and similar color by both day and night." This standard has remained essentially unchanged for 45 years. The MUTCD also says, "To assure adequate maintenance, a schedule for inspecting (both day and night), cleaning, and replacing signs should be established."

Further impetus for attention to sign visibility resulted from the 1993 U.S. DOT Appropriations Act requiring the Secretary of Transportation to "…include a standard for minimum level of retroreflectivity that must be maintained for traffic signs and pavement markings for all roads open to public travel." The FHWA has been working to develop a rational set of minimum levels for traffic signs to facilitate the implementation of nighttime visibility guidelines by highway agencies.

How can highway officials assure that their signs provide reasonable night visibility?

Since the retroreflective properties of traffic control devices deteriorate over time, highway officials should assess their schedules for inspecting, cleaning, and replacing signs to ensure that these maintenance activities meet the objectives of the MUTCD, and more importantly, the needs of drivers at night. Agencies may want to consider implementing improved processes to assess signs for nighttime visibility and/or more cost-effectively manage the sign system. Further, procurement processes can be enhanced to specify sign materials that offer high retroreflectivity performance.

Won't these efforts be costly to highway agencies?

The FHWA plans to phase in the guidelines over a 6 to 10 year period, allowing highway departments to implement improved sign inspection and management procedures in a time frame consistent with the typical sign replacement cycle. Thus, the cost impacts might be little more than the additional cost of using higher performance sign materials. Agencies that choose to make more significant upgrades to their sign management processes to better manage their traffic control device assets can expect additional initial costs. Cost increases from upgrading materials and/or processes may be offset by long-term savings and the benefits of more visible signs.

A 1998 FHWA report estimated that state and local agencies would be faced with the need to replace 5 to 8 percent of their signs to meet the proposed requirements (Publication NO. FHWA-RD-97-053). The costs for any particular agency would, of course, vary by the current condition of their signs and the nature of their current sign management practices.

What benefits will be realized?

Research has not been successful in determining the specific safety benefit of high visibility traffic signs, but intuitively, well delineated and signed highways are considered to be the safest and most efficient for moving traffic. Safe and efficient highways are a benefit to the motoring public and the health and viability of a community.

What is being done to support agency efforts to improve the night visibility of signs?

The FHWA is developing guidelines that reflect the minimum levels of retroreflectivity needed by the majority of drivers. These levels will provide a practical benchmark that can be used to judge whether a sign provides a reasonable level of night visibility. The FHWA also is developing guidelines to help agencies review the in-place signs in their jurisdictions and to manage their night visibility.

The FHWA has contracted to develop and conduct train-the-trainer workshops for Local/Tribal Technical Assistance Programs (LTAP/TTAP). After the LTAP and TTAP representatives have received training, they will be able to assist highway officials to comply with the retroreflectivity guidelines.

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